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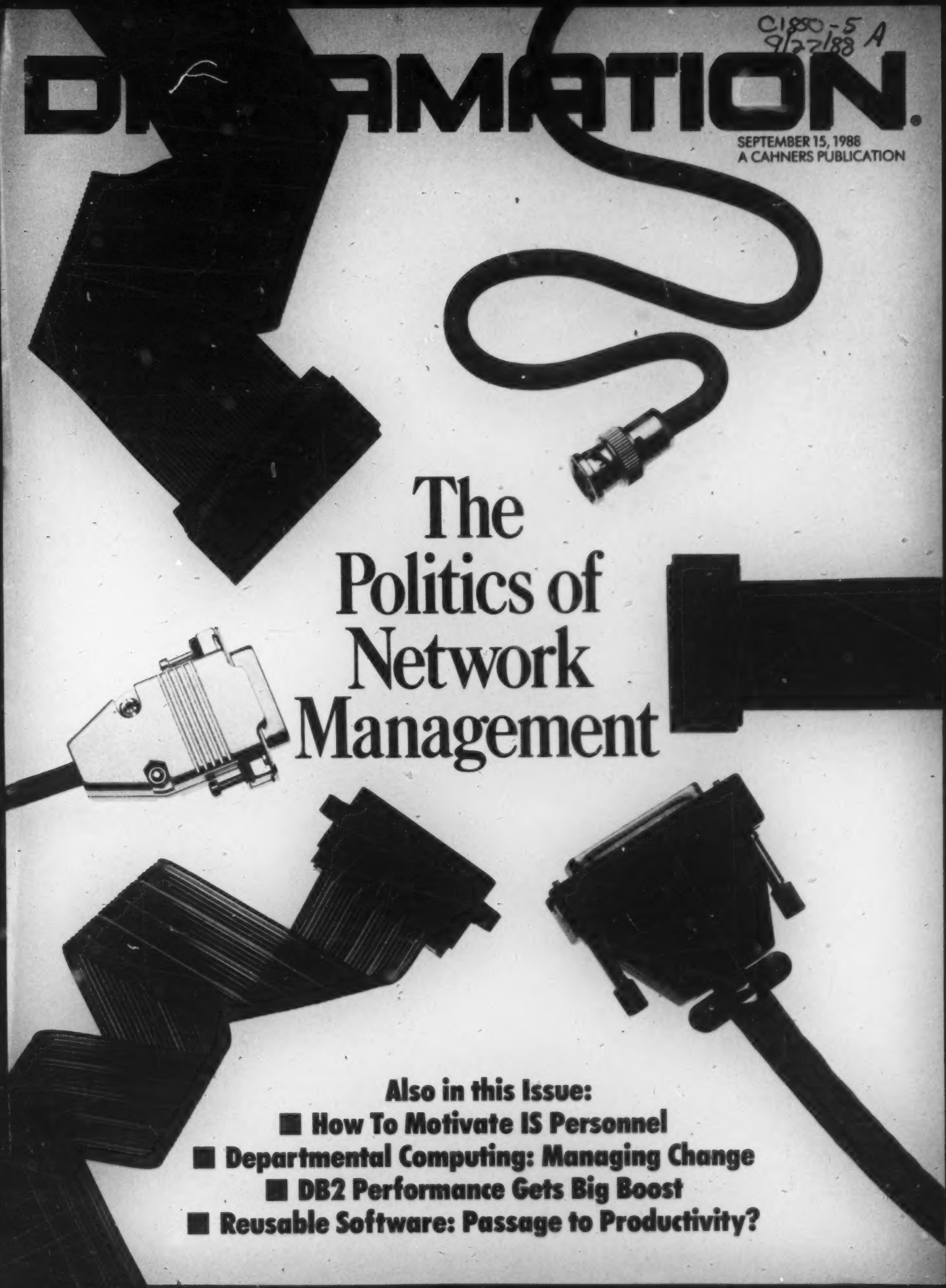

The Politics of Network Management

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The 'Blues' Take the IS Cure

The Challenges of Information Technology: Part I of a McKinsey and Co. report.

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1988 JESSE H. NEAL AWARD

1987 JESSE H. NEAL AWARD

Editorial

The Constantly Moving Crisis

Computers have been blamed for a lot of things in their time. From structural unemployment to the deskilling of workers to tragic aviation disasters, it may seem that few contemporary unpleasantnesses have *not* been laid at the feet of the computer. Now, a new accusation has joined the traditional taunts: computer science is being asked to shoulder part of the blame for a coming decline in the nation's production of medical doctors.

Here's how the argument works: the practice of medicine has been made more difficult by lengthy, expensive training, malpractice suits, insurance costs, and new and hideous diseases; ergo, bright students who might naturally consider medicine as a career are taking other paths that promise to challenge minds and pay well. Prominently mentioned as an alternate being chosen by the ambitious: computer science.

What we have here is a prime example of the Constantly Moving Crisis. When I was researching this month's Behind the News article, "The New Maturity of Computer Science" (p. 37), David Gries, ex-head of Cornell University's Computer Science department, described the state of computer science this way: "It seems that we have emerged from the crisis."

The numbers justify Prof. Gries's good cheer. According to the most recent study of the field by the National Science Foundation, in 1975, there were 8,415 computer science grad students in the U.S. In 1986, the study found 30,726 computer science grad students.

Suddenly, it seems there are enough computer science students. Gries says, "Now, for the first time, good people who try to get into the top 10 or 15 schools are not getting in." And this turns out to be good for IS departments: he adds that many of these talented people, having hit an academic dead end, enter industry.

So, what we have here is a crisis solved, but with the solution leading to another crisis: a possible shortage of doctors. Don't stop there, however: Prof. Alton P. Jensen of Georgia Tech predicts a 50% shortfall of computer science PhDs by the year 2009. I'd be willing to bet that at some time during the first decade of the next century, you'll see a rash of articles suggesting that the new "crisis" in computer science can be laid at the feet of too many students enrolling in, say, medicine.

The Constantly Moving Crisis strikes once more, and the apothegm, "You can't win for losing," will have been proved yet again.

PARKER HODGES
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Letters

The Real VM

Brad Schultz's article "VM: The Crossroads of Operating Systems" (July 15, p. 79) misleads the reader as to the nature and history of VM . . . —and other operating systems.

"VM's own batch facility" is CMS: the article makes it sound as if this were a separate operating system. While it is true that IBM made code changes to support CMS batch, the interactive and batch users not only run under the same version of CMS, but under the same physical copy (shared segment).

The author claims that "The only highly interactive IBM-originated mainframe operating system is Conversational Monitor System (CMS)," which must come as a real surprise to all of the TSO users out there, as well as to those still running TSS/370 (Time Sharing System/370, derived from TSS/360).

Talk of VM eclipsing VSE is a little strange, considering the number of VM shops where the principal guest operating system is DOS/VSE, and considering that the VM support for VSAM requires the VSE VSAM product.

I would be very surprised if the author could back up his claim that VM supports more commercial applications than any other operating system. I suspect that TPF (Transaction Processing Facility, formerly known as Airline Control Program) is the leader, but MVS also looks like a better bet. There are vast numbers of IMS applications that cannot be ported to CMS. Although there is a CMS version of CICS, it is not fully downward compatible, and not all of the array of CICS applications can be ported. On the flip side, many of the VM applications are based on ISPF (Interactive Structured Programming Facility) and could be easily moved.

The claim, attributed to George Schmid, that "TSO, however, can't support the level of editing and debugging tools that programmers generally prefer" is a strange one under the circumstances. TSO has a powerful interactive symbolic debugger, which CMS lacks. Further, MVS tools, although thought of as being for systems programmers, can be of immense help to applications programmers. The MVS/XA table and GTF traces are vastly more user friendly and comprehensive than their CMS and CP analogs, while anyone familiar with SLIP command could only view the CP PER command with disdain.

As for editing, the top-of-the-line editing facility for VM is ISPF/POF; guess where it originated (that's right, TSO). In fact, the TSO and VM versions of ISPF and ISPF/PDF have code in common and are practically identical even where the code is different.

Despite the author's claim, CMS is not the same across all VM versions. The CMS in VMF/370 has not been enhanced in a decade, the CMS in VM/XA SF is backlevel, and the CMS in VM/PC is not only backlevel, but will remain so with the loss of support for VM/PC. Only with VM/SP release 6 (or 5.5) and the eventual demise of VM/XA and VM/XA SF will there be a consistent CMS.

With regard to the issue of OCO (Object Code Only), David McGorry's statement that "we intend for customers to be able to do just what they have always done" cannot be taken seriously. IBM has broken prior commitments about OCO, such as not going OCO without adequate reliability, documentation, and user exits; why is this promise more believable?

SEYMOUR J. METZ
Annandale, Va.

Refreshing

"CIO: Misfit or Misnomer?" by Ralph Emmett Carlyle (Aug. 1, p. 50) is a refreshing return to careful analysis and clear thinking. The statement by John Hammitt, vice president, Information Management for Pillsbury Co., "We don't control information, we make it flow," says it all. The episodes of agony and ecstasy inherent in our field will never change with a change of title, and anyone who thinks a CIO title is a stairway to Corporate Heaven is confused about which way the stairway is leading.

I don't know who actually started this CIO movement, but any vp of IS or director who in this day does not report to the president of their enterprise and does not sit in concert with other executive officers when automation issues are discussed had better reexamine his or her position.

Problems with egos and misperceptions are inevitable whenever power and authority are unevenly distributed, and that is evident in the CIO move. I've been in this field for over 30 years, and the Real Professional Directors and IS vps I know are too busy to be caught up in this hogwash.

WALTER X. KANE
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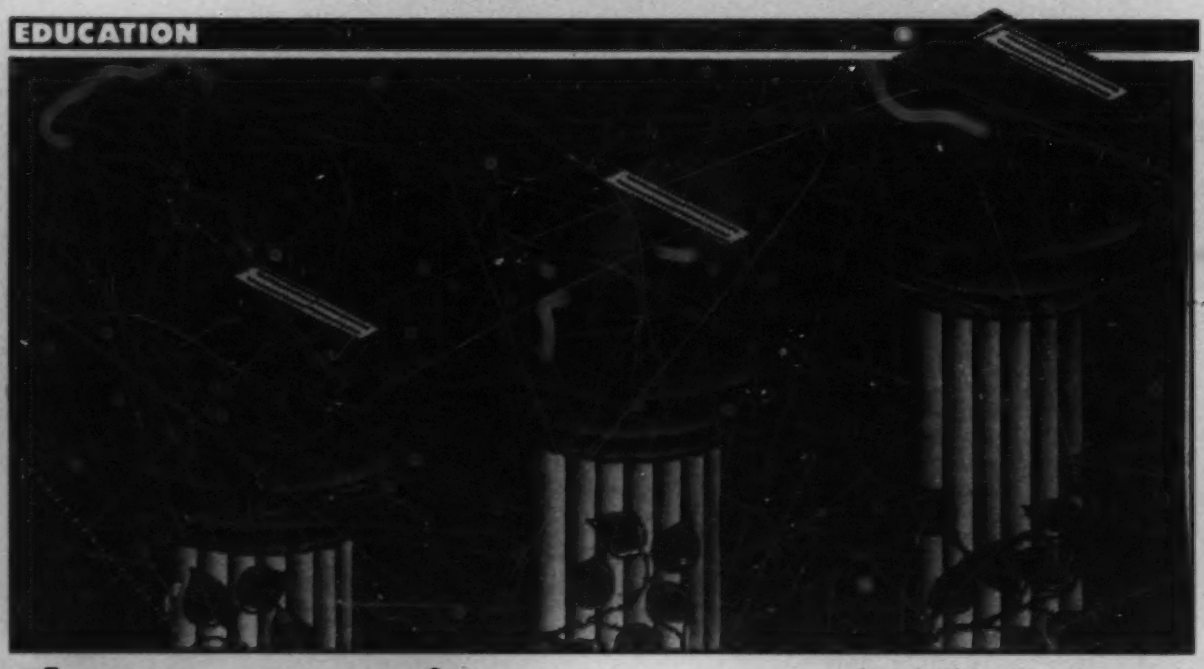
Norwood, Mass.

Behind the News

EDUCATION



The New Maturity Of Computer Science

Accreditation and support from industry and government help remake a troubled discipline. Still, a PhD shortage looms for the long term.

BY PARKER HODGES

Every two years, in high summer, the heads of America's PhD-granting computer science departments gather to talk at an off-season Utah ski resort called Snowbird. There, in the mountains, they assess the health of computer science, the most recent science to enter the academic mainstream.

At the beginning of this decade, the Snowbirders were not happy. "A Discipline in Crisis" was how they described their field in a report for the Association for Computing Machinery. The institutions granting PhDs weren't turning out nearly enough product, and the quality of undergraduate computer science curricula ranged all over the map. But, according to David Gries, ex-chairman of Cornell's Computer Science Dept. and co-chairman of the Snowbird Conference, the mood at this year's meeting was different: "It seems that we have emerged from the crisis."

For a report on how students choose a career in IS, see p. 40.

Among the items that encouraged this year's Snowbirders is a doubling of the number of computer science PhDs granted each year, up to about 500 in 1988 from about 250 in 1980 (though the demand for them is expected to exceed supply through the year 2000). The National Research Council has also set up a Computer Science and Technology Board, which, says Gries, "puts us on a par with the other disciplines."

The Computing Science Accreditation Board (CSAB) is further evidence of the new maturity of computer science. A joint project of the Association for Computing Machinery and the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE), the CSAB opened for business in late 1984 and by July of 1988 had accredited 65 programs. The evaluators are nominated by the ACM and the IEEE; three fourths are full-time educators in the field, the rest are from the high-tech vendor community—with the current crop hailing from AT&T, Siemens, and Stanford Research Institute.

People hiring graduates of computer science departments are also impressed by the new energy that has informed the discipline. Harry Reinstein, president and ceo of Aion Corp., Palo Alto, says, "Most of our recruitment on the development side of the house is from computer science graduates. I have been tremendously impressed by the quality of the people coming out of the bachelor's programs—not just their ability to craft code, but their ability to understand the needs of a company aimed at serving customers."

On the other hand, Norman Statland, national director of information technology, Price Waterhouse, warns that some "pure" computer science graduates "don't have the people skills" that PW needs in its consultants. For that reason, PW's consulting division, which hires between 200 and 300 people a year, looks for "double majors, computer science and accounting, or computer science and business administration."

Another drawback that some observers point to is graduates' unfamiliarity with large projects. Because most schools are organized along the semester or quarter system, many students never get to work on large-scale systems. At some schools, however, undergraduates get a shot at larger-than-usual

Illustration by Didier Cremiux

projects. David Hanson, professor of computer science at Princeton University, says, "Princeton has a heritage of heavy emphasis on independent work, and so most students do anywhere from two to four semesters" of such work. At Rochester Institute of Technology, students spend four quarters in a co-op program working on real problems with real-world employers.

A Discipline with an Infant Subject

A quarter century ago, computer science was an academic discipline waiting to happen. "Unlike most other areas of inquiry, there was no natural arena such as an atom, tissue, or crystal lattice to serve as a source of observations. Instead, the 'universe' of interest was an artifact barely a decade old," wrote Seymour V. Pollack in "The Development of Computer Science," in *Studies in Computer Science* (Mathematical Association of America, Washington, D.C., 1982.)

Still, in 1963, the University of Michigan had something called the Communications Science Program. Carnegie-Mellon University's Dept. of Systems and Communications Science was then a year old. Most academic computing work and training, however, was the domain of electrical engineering or mathematics departments.

Today, according to the Association for Computing Machinery's *Administrative Directory of College and University Computer Science/Data Processing Programs*, there are well over 800 academic programs in computer science or data processing at North American institutions of higher learning, and almost 500 schools have departments called Computer Science. Others find even more programs: the 1987 College Board *Index of Majors* listed 1,085 programs in the U.S. for computer or information science.

There is still a big difference between the best schools and, well, shall we say, the others. Tom Philips, executive director of the CSAB, says that only "a shade over 400 institutions are running professional-objective programs. By that I mean the kind of program with a certain magnitude and balance of core courses, advanced courses, theoretical work, appropriate preparation for later study." Of the first 85 schools that requested accreditation for their computer science departments, 20 were turned down by the CSAB.

Philips says, "We recognize that there are institutions committed to teaching, and that's a good thing. But we are telling schools that, to be accreditable, long-term, they cannot teach their faculty right into the ground and expect them to stay current and not burn out within a few years."

Jack McCredie, chairman of the Education Investment Review Board at Digital Equipment Corp. and ex-vice provost of computing at Carnegie-Mellon University, says, "In many ways, the top handful of computer-related activities happen at four or five major centers of excellence." McCredie mentions specifically MIT, Stanford, Carnegie-Mellon, and Berkeley. Reputations like these mean some schools have it easier than others. Don Dearholt, professor of computer science, New Mexico State University, says of his school's recent accreditation by the CSAB: "If we were as well-known as Stanford or Carnegie-Mellon University perhaps we could [have gotten] away without worrying about it."

Others place the dividing line between the best and the rest a lot lower, citing about "40 or 50 top-ranked schools."

Maintaining Quality

How do the top schools maintain their quality? DATAMATION asked that question of several of the leaders in the field and found remarkable consistency in their answers. Alton P. Jensen, acting director of Information and Computer Science at Georgia Tech, says his department's secret is "high-quality faculty and students." Martin Schultz, chairman of the Computer Science Dept. at Yale University says, "Hire the very best faculty we can. Give them relatively light teaching load. Give them plenty of support from the university and from grants, access to very good students, a quality environment in which to work."

There is agreement, too, on the importance of research grants. Sam Conte, professor emeritus of computer science at Purdue University, says that research money pays off for schools in three ways: "You get the best faculty, the best students, and you get the money as well."

The resources in question can be substantial. For example, in 1986, the most recent year for which figures are available, $289.3 million in privately and federally financed R&D was carried on at 50 college or university computer science centers. But, here too, the cream rises to the top: $186.7 million of this money—almost 65%—went to the top 10 schools: Johns Hopkins, Carnegie-Mellon, the University of Southern California, New Mexico State University, the University of Illinois at Urbana, Stanford, MIT, Cornell, Georgia Tech, and the University of Texas at Austin.

The National Science Foundation is a source of some of this money. For fiscal 1988, the Computer and Information Science and Engineering Directorate of NSF has just under $100 million to spend on computer R&D at colleges and universities. (This figure is only part of federal support for academic computing. Richard Schoen of NSF says the $100 million kitty does "not count grants to the chemistry division for the purchase of computers, or grants to the mathematics department for purchase of computers, or grants to other divisions for support for computers.")

One project through which the NSF delivers help is called the Presidential Young Investigators. This program combines federal and vendor money to finance the purchase of equipment for use by scholars. Say, for example, that a Presidential Young Investigator (PYI) needs an Apollo DN10010 Workstation. The list price for this machine is $87,100. Off the top comes Apollo's 10% educational discount; then Apollo kicks in a $34,840 "matching grant" to the PYI; and NSF matching funds come in with another $34,840. Result: the PYI gets his or her machine with a 90% discount, total price $8,710.

Large Vendors Provide Support

Apollo is not alone in its support of academic computer science. IBM, DEC, Control Data, and many others have large-scale educational programs. IBM says it supports colleges and universities to the annual tune of $61.5 million in cash, equipment, and salaries. DEC says that in fiscal year 1987 it has given well over $100 million to "education-related programs in the U.S. and abroad." DEC's contributions include research funding, direct contributions (scholarships, etc.), discounts, and grant programs. According to Charlotte LeGates, director of communications for the Computer and Business Equipment Manufacturers Association, "many of our companies dedicate about half of one percent of their profit before taxes to educational philanthropy."

On the other hand, vendor contribu-

Twenty-five Top Computer Science Schools

SCHOOL	TUITION†	ROOM & BOARD	AVERAGE STARTING SALARY***	BACHELOR'S DEGREES AWARDED '88	GRADUATE DEGREES AWARDED '88	CURRENT ENROLL-MENT	DEPT. ESTAB.††
Brown University Providence, R.I.	$13,375/yr.	$2,509/yr.	NA	75	NA	NA	1972
University of California San Diego	538/sms. 2,040/sms.*	4,000/yr.	25,000- 29,000	80	16-M 8-PhD	250-U 80-G	1987
Carnegie-Mellon University Pittsburgh	12,000/yr.	4,000/yr.	30,518	NA	15-PhD	165-U	1965
Columbia University New York	12,628/yr.	2,700/yr.	28,600	NA	NA	NA	1980
Georgia Institute of Technology Atlanta	5,886/yr. 9,558/yr.*	1,530/yr.	27,408	38	24-M	626-U,G	1962
University of Illinois Urbana	1,358/sms. 3,128/sms.*	3,386/yr.	28,956	88	85-M 25-PhD	390-U 325-G	1964
Johns Hopkins University Baltimore	12,000/yr.	4,804/yr.	30,000	46	NA	NA	1986
University of Maryland College Park	953/sms. 2,546/sms.*	2,989/yr.	25,000- 35,000	NA	NA	95-U 57-G	1969-U 1974-G
Massachusetts Institute of Technology Cambridge, Mass.	13,400/yr.	4,640/yr.	33,156	99**	0	NA	1972
University of Minnesota Minneapolis	2,460/yr. 5,145/yr.*	4,000/yr.	27,672	84**	60-M 5-PhD	400-U 238-G	Early 1970s
New Mexico State University Las Cruces	642/sms. 2,490/sms.*	595/sms.	27,072	55	13-M 3-PhD	200-U 75-G	1967
State University of New York Stony Brook	1,495/yr. 1,975/yr.*	3,365/yr.	26,000	58	NA	150-U	NA
New York University New York	12,000/yr.	5,850/yr.	25,000	143**	8-PhD** 104-M	600-U 340-G	1969
University of North Carolina Chapel Hill	422.50/sms. 2,223.50/sms.	700/sms.	27,000	50	55-M 1-PhD	100-U 200-G	1969
University of Pennsylvania Philadelphia	12,750/yr.	5,000/yr.	29,150 40,150-M	36	66-M 8-PhD	NA-U 157-G	1965
Princeton University Princeton, N.J.	19,690/yr.	Incl. in tuition	29,688	NA	NA	50-U 35-40-G	1986
Purdue University West Lafayette, Ind.	1,916/yr. 5,800/yr.*	2,510- 2,950/yr.	28,068	NA	20-M 7-PhD	664-U 51-G	1962
Rochester Institute of Technology Rochester, N.Y.	9,075/yr.	3,025/yr.	28,700	100	30-M	550-U 300-G	1972-U 1974-G
University of Southern California Los Angeles	12,972/yr.	6,596/yr.	26,676	NA	NA	250-U 350-G	Early 1970s
Stanford University Stanford, Calif.	4,188.93/qtr.	700/qtr.	41,000-M	18	NA	65-U	1985
University of Texas Austin	436.85/yr. 1,196.85/yr.*	NA	27,500	125	NA	950-U 250-G	1966
University of Utah Provo	464/qtr. 1,280.52/qtr.*	500/qtr.	30,500	47**	7-M 3-PhD	510-U	1976
Washington State University Seattle	597/qtr. 1,664/qtr.*	3,000/yr.	27,500	39	21-M 11-PhD	138-U 122-G	1967
University of Wisconsin Madison	928.50/sms. 2,819.50/sms.*	3,000/yr.	24,500 43,000-M	NA	NA	214-U, 72-M, 89-PhD	NA
Yale University New Haven, Conn.	12,960/yr.	5,000/yr.	NA	NA	NA	NA	NA

M - Master's, U - Undergraduate, G - Graduate
* Out-of-state.
** 1987.
*** For those with bachelor's degrees, except where indicated.
† These are estimated costs, and do not include summer sessions. All figures are for full-time entering freshmen taking a full course load, for a semester. Figures for Carnegie-Mellon, U. of Maryland, New Mexico State, Rochester Inst. of Technology, Stanford, SUNY Stony Brook, and Washington State do not include fees.
†† In many cases, computer science degrees were granted prior to the formal establishment of a computer science department.
Source: DATAMATION

tions can sometimes be more self-serving than they might sound. LeGates says vendors "really do a lot of stuff that leads to overall business goals," and she has advised schools seeking vendor support to tailor their proposals to the business aims of vendors. LeGates adds that some vendor contributions end up in "schools where [vendor] employees' children go." Still, as LeGates pointed out in a 1986 speech to the National Governors' Association Task Force on Educational Technology, "Our companies are deluged by floods of requests that they could not possibly fulfill without going bankrupt."

Nevertheless, things could be a lot better. The number of bachelor's degrees expected to be granted at the 123 top U.S. and Canadian computer science departments in 1988 was the lowest in the last four years. And, according to Georgia Tech's Jensen, "If the current level of computer science PhD production continues, in 2009 we will have only 50% of what we need." Even today, when DEC's Jack McCredie looks at engineering schools he sees "thousands of unfilled faculty positions."

According to "The 1986-87 Taulbee Report," an annual survey of U.S. and Canadian PhD-granting computer science departments conducted under the auspices of the ACM and IEEE, the departments had wanted to add an average of 1.4 new faculty per department, but they managed to add only one new faculty member. The report also suggests that the faculty in the field "continues to be far too young and inexperienced, a problem that only time can solve."

Disturbing, too, are the Scholastic Aptitude Test scores for students planning to major in computer/information sciences. According to a report from the Educational Testing Service, on the verbal half of the SATs, only students planning to attend vocational or technical schools or major in home economics or public affairs and services score lower than future computer scientists. On the math portion of the SATs, students planning a computer science major came in right on the mean for all students who took their SATs in 1987: not great, not dreadful, but below those planning to major in literature, religion, or philosophy. But David Gries says the Graduate Record Exams tell another story. He cites GRE verbal scores for computer science graduate students at Cornell as high as those scored by English graduate students, and scores on the quantitative half of the GREs "just as good as the physics incoming class."

So, while computer science education is in better shape than it has been in the past, no one in the discipline is ready to relax. The ACM and the IEEE have established a joint, 10-member Computer Science Curriculum Revision Committee under the direction of Alan Tucker, Bowdoin College, Brunswick, Maine, and Bruce Barnes, vp of the Software Productivity Consortium, Reston, Va. The committee has been meeting through the spring and summer and will announce its recommendations soon. Many in computer science point to the recommendations of the last joint curriculum committee in 1978 as a milestone in the maturation of the discipline; with any luck, another leap forward may be imminent.■

Research assistance and chart compilation was provided by editorial secretary Anne Mangieri.

How College Students Choose IS Careers

A three-year study of over 500 business students shows that they choose IS early on, but often for the wrong reasons, such as parental pressure.

BY ROBERT A. ZAWACKI, DEBRA KUBERT SCOTT, AND PAUL A. ZAWACKI

IS journals and business publications these days are filled with warnings on the intensifying labor shortage within the computer field. The labor demand is great; one prediction says the need for systems analysts will increase by 76% between now and the year 2000. A recent survey of 100 major corporations reports that four of the five fastest-growing occupations between now and 1995 will involve computers.

Despite the opportunities, article after article reports that the supply of systems analysts, systems programmers, network planners, and software engineers is short and will get shorter through the end of the century.

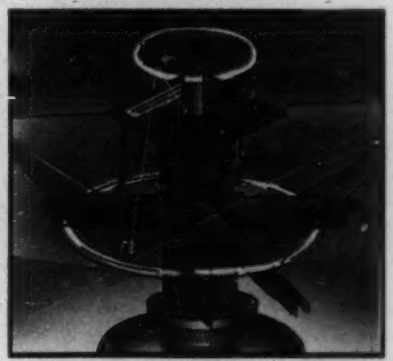


Illustration by Didier Cremieux

It has been suggested that the solution to this shortage lies in the colleges and technical training programs, which, it is said, should do a better job of motivating young people. Indeed, this study and the first author's past research has shown that thousands of young IS professionals apparently enter the profession either for the wrong reasons or based on an incomplete understanding of the job, derived from impressions that they formed in college.

The IS skills crunch thus can be viewed as having been caused by the circumstances surrounding a long process that includes three factors: how young people choose IS as a profession; how each person's ability and motivation match the job; and how each person is managed once on the job.

Having already researched the second and third factors, we conducted a three-year study of how 530 business students at two major U.S. universities selected a career in information systems.

IS Careers Generally Chosen Early

Regardless of the reasons, the study shows that a large percentage of IS majors reached the achieved and moratorium status categories (see "The Study: Methodology and Definitions"), indicating that they firmed up their career decisions much earlier than did other business majors.

The first set of charts shows what percentage of survey participants at different levels of study falls into each sta-